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Leaf Stay-Green Modulates Carbohydrates Partitioning and Metabolism in Sweet Sorghum under Post-Anthesis Drought

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Abstract

Whereas the benefits of leaf stay-green for maintaining grain filling in sorghum under drought was largely demonstrated, its role in the stability of a dual production (grain, stem sugar) in tall, sweet sorghum remains unclear. This study aimed to analyse the impact of a post-anthesis drought on sugar accumulation along stem internodes in sweet and tall West-African sorghum with variable leaf stay-green and grain yield abilities. Five accessions with similar phenology were studied in two consecutive years in the field in CNRA (Bambey, Senegal) under two post-anthesis water treatments (irrigated, non-irrigated). Stem height and panicle dry weight (PDW) were evaluated at maturity and green plant leaf area (PLA) at flowering and maturity. Carbohydrate contents (sucrose, hexoses, starch) were determined during grain filling in the whole stem juice and at three internode levels: bottom, median, top. PDW was not affected by drought, but strongly variable among years and accessions. Plant leaf area was significantly reduced by drought and varied with the year, to a variable extent depending on the accessions. Total soluble sugar content (SST) in the whole stem juice was slightly reduced by drought, which was significant only for some accessions. This was mainly explained by its reduction rate in top internodes. PLA to PDW ratio was negatively correlated to SST reduction both at stem juice and internode level across studied accessions. The higher the internode level the more negative this relation. Accordingly, accessions with the highest grain production capacity benefited from leaf stay-green to fill grains without mobilising stem sugar stored in the stem, particularly under drought. It is suggested that, leaf stay-green is an important trait to consider for sweet sorghum breeding and particularly in the objective of developing dual purpose varieties in drought prone environments.

Keywords: Carbohydrate partitioning, Internode, Juice, Post-anthesis drought, sweet sorghum

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